COLLECTION of ECOLOGICAL DATA for SOIL - SITE CORRELATION in OREGON

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E. Wm. Anderson and Charles E. Poulton[1/]

The authors are engaged, both independently and cooperatively, in the ecological analysis of range sites in Oregon. The "Plant Community Data" section of the "Site-Soil Correlation--Woodland and Range Field Data Sheet" is based upon this experience (Appendix II).

Since the same ecological principles are involved in the study of range and of forest sites, this field data sheet should provide a satisfactory, uniform procedure for recording the basic data about both range and forest sites. The soil-site relationships can be clarified when these data are available.

These instructions set forth some of the principles basic to soil-site investigation and detail certain procedures where the intent of the Field Data Sheet is not self-evident.

Previous Work and Acknowledgments

The original data sheet, "Tree Growth and Land Factors," for recording data about soils and sites was developed by Paul E. Lemmon and Clyde E. Deardorff of the U. S. Soil Conservation Service soil correlation staff. The original form provided for soil profile data, tree growth data, some general data about the study location and limited data about the understory. The attached data sheet (Appendix I and II)

1/ Range Conservationist, Soil Conservation Service, Pendleton, Oregon, and Associate Professor of Range Management, Oregon State College, respectively.

represents a revision of the original general data and tree growth data sections, a slight revision of the soils data section, and the addition of a new section for plant community data.

Acknowledgment is made to the following persons for their review and suggestions on the plant community and general data sections of the new form: Paul E. Lemmon, S. C. S. Soil-Woodland Specialist; Waldo Frandsen, S. C. S. Range Conservationist (West); Orlo Krauter, S. C. S. Woodland Conservationist (West); Roy Johnson and William Sauerwein, S. C. S. Woodland Conservationists for Oregon; and R. W. Mayko, S. C. S. Soils Specialist for eastern Oregon.

General Principles

Correct ecological evaluation of native plant communities and comprehension of relationships between range and forest sites and their soils depends upon certain principles which must be adhered to in the investigation of these relationships. These principles are discussed briefly. A more detailed treatise of the principles, concepts and procedures will be published in the future as a result of cooperative regional research in the Northwest.[1/]

Most of these ideas have been previously discussed in unpublished papers given at various technical and scientific meetings (1, 2, 6, 7, 8) and the results of this kind of investigation have been

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1/ Regional Project, W-25, Ecology and Improvement of Brush Infested Ranges. The project is cooperative between the states of Idaho, Oregon and Washington with project leaders E. W. Tisdale, C. E. Poulton, and R. Daubenmire, respectively, representing the states. Some of the work which has contributed to the development of the dominance method reported here was supported in part by this regional research project, and the contributions of these colleagues are gratefully acknowledged.

presented by Anderson (3), by Eckert (4) and by Poulton (5). The procedures for dominance ratings, ground cover estimates and age-class notations are included in the Oregon work plans for the above mentioned regional research. Publication of these work plans is contemplated. This background of work has indicated the essential nature of the following principles:

1. Vegetation and soils must be studied together at the same locations.

2. Study locations must be rigorously stratified so that only one kind of plant community and one kind of soil are considered in each set of data.

3. Vegetation writeups should include all the species with an estimate or measure of the relative dominance of each.

4. Soils descriptions should be made according to National Soil Survey Standards at the phase of a soil type level.

5. Concise interpretation of a phase of a soil type has the same importance on range and forest land that it does on cropland, but the criteria for designating phases on range and forest land may differ. For example, stoniness significant as a soil phase on cropland may not distinguish a significant phase on range or forest land.

6. Refinement of ecological interpretation and comprehension of vegetation-soil relationships are impossible if every plant community is considered static. One must be aware of the signs which indicate that certain species are actively and currently replacing others in some plant communities.

INSTRUCTIONS FOR USE OF FIELD DATA SHEET

This form was designed to record essential information with some flexibility provided in its use. Information which may be accumulated by the use of this Field Data Sheet can contribute to the understanding of range or forest ecology, including soil-site relationships, if the data are properly recorded and carefully interpreted.

This understanding will contribute to the development of improved range condition and trend guides and yield indices.

It is most important to recognize that a small amount of carefully taken information is worth more than a complete data sheet of inaccurate approximations and impressions. Inaccurate records may even preclude proper interpretation of accurate data. Once a record is "cold," it is difficult if not impossible to distinguish accurate from inaccurate data.

Soil-Site investigations may be conducted at two levels of intensity--reconnaissance and intensive study. The objective of the reconnaissance level is to become generally familiar with the vegetation and soils over a rather wide area and to arrive at some tentative hypotheses as to vegetation units and the vegetation-soil relationships. Reconnaissance data should be identified as such and kept separate from the more complete data obtained by intensive study. Final interpretations should not be attempted from reconnaissance data alone. The intensive level provides reasonably complete data about the plant communities and their related soils. This phase can follow or be concurrent with the reconnaissance phase of the study and has as its objective the comprehensive analysis of the vegetation, soil and other relevant environmental factors. Such detailed data provide the basis for testing earlier hypotheses and for making additional ecological interpretations.

It is generally desirable to restrict intensive observations to a constant size and shape of macroplot. This has three important advantages:

1. It emphasizes the care required to keep from averaging observations from two different sites into one record.

2. It provides information on the "Constancy" of occurrence of species in different stands.
3. It provides a specific reference location for studying the related soil.

Macroplot sizes found satisfactory for this kind of investigation are 5 x 25 meters; 50 x 100 feet; 50 x 150 feet; and 100 x 100 feet.

The Field Data Sheet (Appendix I and II) is designed so that it can be used for both reconnaissance or intensive study records. It has been prepared on translucent paper so that data independently collected by technicians can be reproduced through a simple, economical method and made available to those evaluating site data.

It would be greatly appreciated if each person using the Plant Community Data section would review it critically for potential improvements and submit these suggestions to the authors. Periodic revisions are planned for inclusion of significant improvements.

GENERAL SITE DESCRIPTION

Map Grid

Locate the approximate plot position according to legal subdivision.

Climate

Where available, record such data as estimates of summer maximum and winter minimum temperatures, precipitation amounts and distribution, etc. Where desired, indicated the general character of the climate such as "semi-arid temperate," etc.

Slope Aspect

Indicate by eight points of the compass, i.e., N, NE, E.

Slope Azimuth

Indicate within ten degrees the azimuth for the direction of slope at the plot. In areas where direction of slope seems to be an important environmental factor, these data are very important.

Active Erosion

Use this rating when it can be judged with reasonable accuracy. Extreme care should be used not to misinterpret such factors as frost heave and normal creep on steep slopes as evidences of accelerated erosion.

TREE GROWTH MEASUREMENTS

Instructions for recording data in this section are contained in "Instructions for Gathering Survey Information to Correlate Soils and Other Factors with Timber Site Quality," Supplement to Soil Conservation Survey Guide, October 1953, Soil Conservation Service, 209 S. W. Fifth Avenue, Portland 4, Oregon.

SOIL PROFILE CHARACTERISTICS

Data in this section should be taken in conformity with national standards of the Soil Survey Division, U. S. Soil Conservation Service. Instructions are to be found in the Soil Survey Manual, U. S. Department of Agriculture Handbook No. 18, beginning on page 123.

PLANT COMMUNITY DATA

Appendix II is adapted for recording ecological data on range and forested range sites, although it is equally useful in forest ecology where the relationships between undergrowth, overstory and soils are important. Where the following items do not apply to forest sites, an asterisk is used.

Range Site

Record the name of the site and, where established, its symbol. On reconnaissance, or in areas where these investigations are just starting, it may be advisable to omit this blank until sufficient information has been accumulated to develop a satisfactory system of nomenclature and symbolization.

*Stand for Site

Circle the appropriate rating. This item is judged on the basis of the present stand relative to the approximate climax stand for the same site.

*Estimated Condition Class

Circle the appropriate rating. If 75 per cent or more of the present composition is represented in the approximate climax for the site, the present plant community is classed as Excellent condition. Similarly, 50 to 75 per cent is classed Good; 25 to 50 per cent, Fair; and 0 to 25 per cent, Poor. In general, reasonable ecological stability of the site is indicated in the Excellent and Good classes while relative instability is indicated by the Fair and Poor classes.

Depth Litter

Record the depth of undecomposed plant residues.

Depth Humic Mulch

Record the depth of decomposed, unidentifyable plant residue which has not yet become incorporated into the mineral soil.

Forage Yield

Record the estimated pounds per acre of useable forage, air dry weight.

Vigor of Key Forage Plants

List and rate one or more of the key forage plants. Generally, under Excellent and Good conditions these will be the perennials most apt to decrease in abundance with abuse from fire, grazing, etc. Under Fair and Poor conditions they may also include perennials that increase under non-abusive use and are therefore important in predicting range trend.

Bare Ground

Record the estimated per cent of the plot area that is bare, unprotected soil surface. This figure can be very important in the interpretation of composition per cent data and in determining condition.

Stone Cover

Record the estimated per cent of the plot area consisting of exposed rock out-crops, stones, cobbles and large gravels. Rocky, stony, cobbly and gravelly surfaces are characteristic of some sites while in others they indicate past disturbance.

Mosses and Lichens

Record the estimated per cent of the plot area covered by a moss and/or lichen pad or crust.

Species

Space is provided for thirty species. The use of scientific names is preferred. Different species within the same genus frequently have contrasting indicator value, and common names do not exist for some important indicator plants. The use of four-letter symbols based upon the scientific name facilitates note taking. Common and scientific names can be correlated when the site guides are prepared.

If an unknown species is common in the stand or if it is encountered with regularity in different stands representing the same site, assign it an identification number, collect a good specimen, record it on the data sheet by number and later identify the plant or send it away for identification at the first opportunity. Almost any state college or university herbarium will gladly make identifications in exchange for good herbarium specimens having full annotation as to site and location.

Four kinds of data are provided for in the columns of the Plant Community Data section. The four kinds of ratings provide a complete picture of the whole plant community as a basis for ecological interpretations of (1) successional relationships among species, (2) taxonomic units of the climax vegetation, (3) species behavior under various kinds of uses and levels of management, (4) characterization of sites and determination of variations in their characteristics, and (5) development of site descriptions and guides for use in management.

This section of the form may be used in a variety of ways. The intent herein is to describe the minimum procedure which, according to experience, will provide adequate data for the objectives of site-soil correlation studies. Refinements may be added to this minimum procedure as desired.

Age Class Rating: Relative age class data for trees and, if desired, for shrubs in the plant community are used for the interpretation of seral relationships among the species--thus contributing to the correct identification of climax. Age class data reflect the degree to which species are perpetuating themselves on the site, may indicate a period

of significant influx or decline, and otherwise are helpful in ascertaining changes in the plant community that are associated with management. Age classes will be indicated by use of a four-point diamond symbol as follows:

SYMBOL	TREES	SHRUBS
	Seedlings	Seedlings and very small plants
	Saplings	Intermediate size plants
	Poles and thrifty	Nearly mature plants but retaining vigor
	Mature and over-mature	Over-mature plants

If all age classes of a species are present in a stand, the symbol would be a complete diamond, i.e.,  . If one age class of a species significantly dominates all other age classes for that species this may be indicated by a double line on the appropriate portion of the diamond. For example,  indicates that seedlings predominate but that all age classes are represented.

Two or more age classes and/or two or more species may have double-line symbols if the age classes represented by both double lines equally predominate over all remaining age classes.

Dominance Ratings: Past usage of the common five-unit scale of "Abundance" involved vague meanings of "very abundant," "common," "rare," etc. Poulton has more precisely defined five imperical ratings for "Dominance" to facilitate recording the visual appearance of plant communities.

Dominance Rating	Meaning
5	The species which dominates the aspect of the community or layer. Some stands may not have a species which clearly rates a 5. In such cases this class should not be used.
4	The codominant species in the aspect of the community or layer. This is the second most prevalent species which either shares dominance or is subordinant only to the stand or layer dominant. In stands lacking an outstanding dominant, the two most prevalent species may be assigned a 4-dominance rating if they are approximately equal.
3	The species which are easily seen by standing in one place and looking casually around.
2	These species can be seen only by moving around in the community or looking intently while standing in one place. Species occurring in patches encountered only by moving about in the community would be rated 2-dominance although within the patch the species may rate a higher dominance value.
1	These are species which can be seen only by searching for them in and around other species. Species which occur in extremely wide-scattered and isolated patches would also rate a 1-dominance provided they did not represent an inclusion of a different plant community.

This system of dominance ratings has been field-tested by a number of people in Oregon and found satisfactory for recording the appearance of a plant community. Because of its speed, it is particularly suited as a reconnaissance technique. It enables one easily to visualize the stand by looking at the data.

These ratings may be used in three ways: (1) as a single set of ratings for the entire community; (2) as multiple sets of ratings for each layer in the community, i.e., trees, shrubs, herbs; or (3) as a double set for the combined layers of "overstory" and "understory." Advantages can be stated for each of these approaches, and thus individual

preference should probably determine the choice. If either alternative (2) or (3) is used, the relative order of dominance of the layers should be indicated.

Ground Cover Rating: These data represent the estimated per cent of the plot area that is covered by the natural, fully developed foliage spread of each species. The estimates are made by a vertical downward projection of the crown peripheries of each species. Holes and openings within this periphery are disregarded. Obviously the total of the Ground Cover column may exceed 100 per cent, especially in multiple-storied plant communities.

Ground cover percentages by species are considerably more reliable than are species composition percentages for characterizing approximate climax plant communities and condition classes. Several reasons for this are apparent, they include:

1. Learning to estimate species ground cover is easier and can be done with greater consistency among observers who have not trained together. In the ground cover method species are considered one at a time in relation only to the per cent of ground covered by that one species. In composition estimation it is necessary to keep all species in mind while performing the mental gymnastics of deciding on the relative percentages of each.
2. Stand density, an important criteria for rating range condition, is reflected in ground cover percentages. It has to be a separate consideration, generally with

vague criteria, when using composition percentages.

3. Ground cover estimates readily indicate the ecological contribution certain species make to the plant community. The importance of many indicator species is often obscured by composition percentages. Plants such as Sandberg's bluegrass, cheatgrass and other annuals, sagebrush and similar open-canopied shrubs contribute significantly to the plant community yet are not readily reflected in composition percentages because of their growth form.

4. Total ground cover percentages can be used as an index of the vegetational productivity and the effective environment of the site. Composition estimates always total 100 per cent regardless of productivity or condition of the site while total ground cover will vary in direct proportion to productivity and condition.

5. Changes in ground cover percentages for species readily indicate changes in plant vigor and stand density. These are less readily distinguished by composition percentages. Changes in plant vigor may be associated with inherent site responses to management and are, therefore, significant considerations in the evaluation of site and the plant community.

Total herbage cover fluctuates more with annual climatic variations than does basal area and thus may not be as well suited to certain research applications as are indices and measures of basal area. In spite of this apparent disadvantage of herbage cover, the technique has been

found well suited to the evaluation of range and forest sites in investigations similar to those for which this Field Data Sheet was designed.

*Composition Ratings: These data represent the per cent which each species contributes to the total herbage cover on the site or to the total understory herbage cover on forested sites. The estimates are made by mentally compressing the open canopied forbs, shrubs, and tree reproduction and by grouping the smaller plants into a 100 per cent dense herbage cover. Since each species is rated as to its contribution to the total, the percentages in this rating must total 100 per cent.

Composition percentages are presently the basis for determining range condition class and the response of sites to various kinds of use and levels of management. Continued use of composition percentages is necessary until such time as correlated ground cover data are available.

Literature Cited

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SOIL - SITE CORRELATION - WOODLAND and RANGE FIELD DATA SHEET

PLOT NO

Date _____ State _____ Photo No. _____

Land Resource Area _____ Location _____ Sec. _____

Technicians _____ Twp. _____

Land Farm _____ Elev: _____ Precip. _____ Climate _____ Rge. _____

Slope (shape) _____ (%) _____ Length _____ Aspect _____ °Azimuth _____

N / W / E / S

Position _____ Active Erosion _____ Wind Water _____ Sheet Rill Gully _____ Slight Moderate Severe

Gullies -(Ave. Cross Section) _____ Sq. Ft. Length _____ Ft./Ac. Inches Removed _____ _____ _____

TREE GROWTH MEASUREMENTS

Tree No.	Species					Height	Age	DBH	Crown								

Site Index and Class _____ Quality of Determination: ____ E ____ G ____ F ____ P _____

Ave. Basal Area _____ How Determined _____

Ave. Overstory Density _____ % How Determined _____

Remarks: _____

PLOT NO.

SOIL PROFILE CHARACTERISTICS

	Horizons	Depth	Texture	Structure Grade Size Type	Boundary	CONSISTENCE Plastic Stickiness	CONSISTENCE Firmness Mor D	COLOR Dry	COLOR Moist	pH	% Rock > 2mm	Root Distribution	Soil Material Kind of Clays · Clayflows, pores · Cementation Lime, Iron, Silico: Free Carbonates - Effervescence with Ten Percent HCL · Salts: Mottling: Concretions: Pans: Krotovinas: Etc.

Drainage _____ Parent Material _____

Mapping Symbol _____ Series Type _____ Soil Classification _____

Remarks _____

Appendix II: Sample Section, Plant Community Data for Soil-Site Correlation--Woodland and Range Field Data Sheet.

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PLANT COMMUNITY DATA: Range Site ______________

Stand for Site: Full; ¾; ½; ¼; 1/10; Est. Cond. Class: EC GC FC PC

Depth Litter_____in.; Depth, Humic Mulch _____in.; Est. Forage Yld. __________#/Ac.

Vigor Rating of Key Forage Plants:

Species:	RATING HIGH	MEDIUM	LOW

ITEM and SPECIES	AGE CLASSES	DOMINANCE	GROUND COVER (PERCENT)	PLANT COMPOSITION (PERCENT)
Bare Ground	X X X	X X X		X X X
Stone Cover	X X X	X X X		X X X
Mosses and Lichens	X X X	X X X		X X X
Litter and Mulch	X X X	X X X		X X X

SPECIES	AGE CLASSES	DOMINANCE	GROUND COVER (PERCENT)	PLANT COMPOSITION (PERCENT)

Appendix I: Sample Sections, Tree Growth and Soil Profile Characteristics for Soil-Site Correlation--Woodland and Range Field Data Sheet.

USDA-SCS-PORTLAND, OREG. 1955